picnic grounds. On the back of the map are brief descriptions of all the places shown except the national forests and the Indian reservations. The Federal Reservations are listed under the executive departments having jurisdiction over them, and the other reservations are grouped according to states.

DISCUSSION

THE CHEMICAL NATURE OF ENZYMES

ENZYMES are regarded as specific catalysts of biological origin and of high molecular weight. Willstätter[1] pronounced the view that they consist of a carrier, colloidal in nature, and of one or several chemically active groups. This hypothesis has been widely accepted, as it accounts both for the physicochemical and the chemical behavior of the enzymes. The colloidal carrier determines the stability and the magnitude of catalytic activity of the active groups, while the nature of the active groups is responsible for the specificity of the enzymes.

This view is supported by observations on enzyme-like substances of known structure. Pure oxy-hemoglobin is known to possess a marked peroxidase action[2] and a very insignificant catalase action[3] at the same time. Hemin, on the other hand, has only a slight peroxidase effect, but a very pronounced catalase activity. Mesohemin, formed by introduction of two hydrogen atoms into hemin, displays no catalase action at all, but is a strong peroxidase. Thus, a small change in the nature of the active group, such as the introduction of two hydrogen atoms, produces great qualitative changes in enzymatic specificity.

On the other hand, a change in the nature of the colloidal carrier produces a quantitative rather than a qualitative change in activity. In the case of purest oxy-hemoglobin crystals from different species,[4] demonstrated quantitative differences in the peroxidase action of these substances, which are composed of identical hemin, but different globins.

The chemical character of the active groups in natural catalase and peroxidase has been cleared up in recent years. Zeile and Hellstrøm[5] have shown by photospectrometric measurements on highly purified enzyme preparations that an iron-porphyrin complex has to be regarded as the active group of liver catalase and of pumpkin catalase. Similarly, Kuhn, Hand and Florkin[6] demonstrated the proportionalism between the content of porphyrin-bound iron and peroxidase activity in horse-radish preparations. Even the most highly purified preparations of peroxidase (20,000 times from raw horse-radish), contain only 0.1 per cent. of porphyrin. One can see from this that enzymes occur in Nature in very great dilution only, but are extremely active as catalysts. Thus it appears that the chemical nature of the colloidal carrier is mainly responsible for the great quantitative differences in activity of the porphyrin-iron group which obtain between hemoglobin and its derivatives on one hand and the naturally occurring catalases and peroxidases on the other.

The colloidal carrier of an enzyme can be altered in its composition, according to Willstätter, Graser and Kuhn's observations on yeast saccharase,[7] either by choosing a different variety of yeast or by changing the procedure of purification, sometimes with and sometimes without significant change in enzyme activity. The same principle applies to some of the highly purified preparations obtained in the form of crystallized proteins, namely, the crystalline urease of Sumner[8] and the crystalline pepsin of Northrop.[9] Trypsin digestion of the crystalline protein of urease takes place without significant change in urease activity.[10] In the case of crystalline pepsin, it has been shown by Dyckerhoff and Tewes[11] and in our laboratory[12] that the protein which carries the peptic activity can be changed arbitrarily by the adsorption of the active component on crystalline plant proteins, leaving the original protein carrier without activity.

These crystalline enzyme preparations should be regarded, then, as adsorption compounds of the true enzymatic component plus crystalline protein to which they have a special affinity. The finding of crystalline protein-enzyme compounds may lead to the concept that enzymes are merely proteins, and thus cause investigators to disregard enzyme specificity which can only be explained by the existence of highly specialized active groups.

The researches on catalase and peroxidase have shown that their active groups are non-protein in character. The way is thus cleared to investigate the nature of the enzymatically active groups of other

1 R. Willstätter, *Ber.*, 55: 3601, 1922.

2 R. Kuhn and L. Brann, *Ber.*, 59: 2370, 1926.

3 F. Haurowitz, *Z. physiol. Chem.*, 198: 9, 1931.

4 R. Willstätter and A. Pollinger, *Z. physiol. Chem.*, 130: 281, 1923.

5 K. Zeile and H. Hellstrøm, *Z. physiol. Chem.*, 192: 171, 1930; 195: 39, 1930–31.

6 R. Kuhn, D. B. Hand and M. Florkin, *Z. physiol. Chem.*, 201: 255, 1931.

7 R. Willstätter, J. Graser and R. Kuhn, *Z. physiol. Chem.*, 123: 1, 1922.

8 J. B. Sumner, *Jour. Biol. Chem.*, 69: 435; 70: 97, 1926; J. B. Sumner and D. B. Hand, *Naturwiss.*, 16: 145, 1928.

9 J. H. Northrop, *Jour. Gen. Phys.*, 13: 739, 1930.

10 E. Waldschmidt-Leitz and F. Steigerwaldt, *Z. physiol. Chem.*, 195: 260, 1931; 206: 133, 1932.

11 H. Dyckerhoff and G. Tewes, *Z. physiol. Chem.*, 215: 93, 1933.

12 E. Waldschmidt-Leitz and E. Kofranyi, *Naturwiss.*, 21: 206, 1933.

enzymes. Only in this way, one may expect to find an explanation for the high specificity of enzymes and for the mechanism of their action.[13]

E. WALDSCHMIDT-LEITZ

PRAGUE

REDWOODS AND FROST

DURING the cold period in the second week of December, 1932, the coast redwood, *Sequoia sempervirens,* was noticeably frosted in the northern part of its range in Del Norte and northern Humboldt Counties, California. The damage was general but not severe and was confined to the new growth on trees in exposed situations and the outer foliage of young trees. The leaves in many instances were browned as if by a fire.

From December 8 to December 15, inclusive, a period of eight days, minimum free air temperatures of from 30° to 22° Fahrenheit were recorded at the Eureka station of the U. S. Weather Bureau. During this time departures from the average daily temperatures ranged from −15° to −18°. The minimum low of 22° occurred on December 12. The only other period of cold which is comparable in intensity and duration was experienced in the winter of 1887–1888 a few years after the establishment of the Eureka Weather Bureau Station. At that time the lowest recorded minimum of 20° was registered, and minima of less than 32° were experienced for seven days. The recent cold spell was characterized by unusually low relative humidity for the place and season; the percentage at noon from the 10th to the 13th varied from 27 to 20. The low humidity probably intensified the effects of the freezing temperatures.

The reaction of the redwoods to the present winter weather throws some light on the question of the seemingly anomalous northern boundary of the redwood belt. The redwoods are manifestly limited at the south by insufficient precipitation and low humidity, but the reason for the location of the northern boundary has not been clear, since there is little difference between the climate of the northwestern coast of California and the southwestern coast of Oregon. The northernmost grove of redwoods, now logged off, consisted of about forty acres of mature trees and was located a few miles north of the California state boundary and about twenty miles inland on an elevated table-land at an altitude of about 2,000 feet. There are scattered mature trees on the high benchlands along Smith River from 20 to 25 miles to the south of this grove at altitudes of from 1,500 to 2,500 feet. The nearest extensive grove is found on the coastal shelf at the mouth of Smith River about 15 miles southwest of the northernmost grove. The Smith River groves are open to the influence of the sea wind at all times. It should be noted that the elevated bench-lands and the coastal shelf are both protected from the formation of the pools of cold, dry air which accumulate during the high pressure conditions in the winter, and are thus naturally frost-protected habitats.

A major part of the reproduction in the established redwood groves is by stump sprouting, but any advance of the species into new territory must be by means of seedlings. It may be that these seedlings are killed during the occasional cold winters in the northern part of the range and that the northern boundary of the redwood belt is defined by the maximum tolerance of the species for frost.

The writer hopes to report later on the effect of the frost on the stump sprouts in the northernmost grove and the reaction of the seedling trees to the present inclement winter weather.

HARRY D. MACGINITIE

STUDIES ON THE BOTTOM FAUNA OF FRESH-WATER LAKES

A VERY interesting and valuable paper discussing the littoral population of western Lake Erie within the six-foot contour appears in the April number of *Ecology*.[1] On page 82 the authors state that no population studies have been made in which the shore is divided into physical areas and depths and the quantitaitve results published in detail. Had the authors delved more deeply into the bibliography of the subject they would have found at least two papers[2] dealing with population problems of the littoral area described in great detail. These cover studies on Oneida Lake, New York, and on Winnebago Lake, Wisconsin. Neither of these lakes have the shelving rock habitat of the shore of Lake Erie, but the other shore habitats, such as boulder, gravel, sand, clay and mud, are present. The populations of these areas per square meter in the two lakes studied are shown below

	Oneida Lake	Winnebago Lake
Boulder bottom	1,945	321
Gravel bottom	1,944	1,579
Sand bottom	3,421	1,326
Clay and mud bottom	5,866	1,450
Vegetation	263	4,400

[13] E. Waldschmidt-Leitz, *Phys. Reviews*, 11: 358, 1931.

[1] "Bottom Shore Fauna of Western Lake Erie," F. H. Krecker and L. Y. Lancaster, *Ecology*, 14: 79–93, 1933.

[2] F. C. Baker, "Productivity of Invertebrate Fish Food on the Bottom of Oneida Lake, with Special Reference to Mollusks," N. Y. State Coll. Forestry, Tech. Pub. 9: 11–233, 1918; "The Fauna of the Lake Winnebago Region," Trans. Wis. Acad. Arts and Sci., 21: 109–146, 1924.